

MARINE OSTRACODA FROM THE WESTERN NORTH ATLANTIC OCEAN BETWEEN CAPE HATTERAS, NORTH CAROLINA, AND JUPITER INLET, FLORIDA

NEIL C. HULINGS¹

Department of Biology, Texas Christian University, Fort Worth

ABSTRACT

A total of 72 species of Recent marine ostracods are reported from 54 stations, ranging in depth from 9 to 795 m, in the area between Cape Hatteras, North Carolina, and Jupiter Inlet, Florida. Three depth zones are recognized, and include depths less than 50 m with 16 diagnostic species, 50 to 200 m with 4 diagnostic species, and depth greater than 200 m with 7 diagnostic species.

One new species, *Macrocypris bathyalensis*, is described.

INTRODUCTION

During 1953-54, the Biological Laboratory of the Bureau of Commercial Fisheries at Brunswick, Georgia, carried out an extensive sampling program with the M/V THEODORE N. GILL. The area sampled was between Cape Hatteras, North Carolina, and Jupiter Inlet, Florida. The location of the stations is shown in Figure 1.

Anderson, Gehringer & Cohen (1956a, 1956b), and Anderson & Gehringer (1957a, 1957b, 1958a, 1958b, 1959a, 1959b and 1960) have summarized the basic oceanographic, biological and chemical data for each station. Moore & Gorsline (1960) have presented data on the physical and chemical aspects of the sediments.

Sediment samples were taken by means of an orange-peel grab. The device was modified by the addition of lead to the arms and by welding covers over the blades to prevent the sample from being washed out following recovery from the bottom. The sediment samples were then placed in polyethylene bags without the addition of preservative. Aliquots of the original samples were obtained for study of benthonic ostracods.

The GILL collected sediment from 71 of 80 regular stations. Ostracods were found in sediments from a total of 54 stations. Some of the stations were sampled more than once, and in some cases ostracods were found in only one of the several samples from one station. The solid circles in Figure 1 designate stations where ostracods were collected; the open circles designate stations where sediment was collected but no ostracods were found.

¹ Present address: Smithsonian Institution, Washington, D. C. 20560.

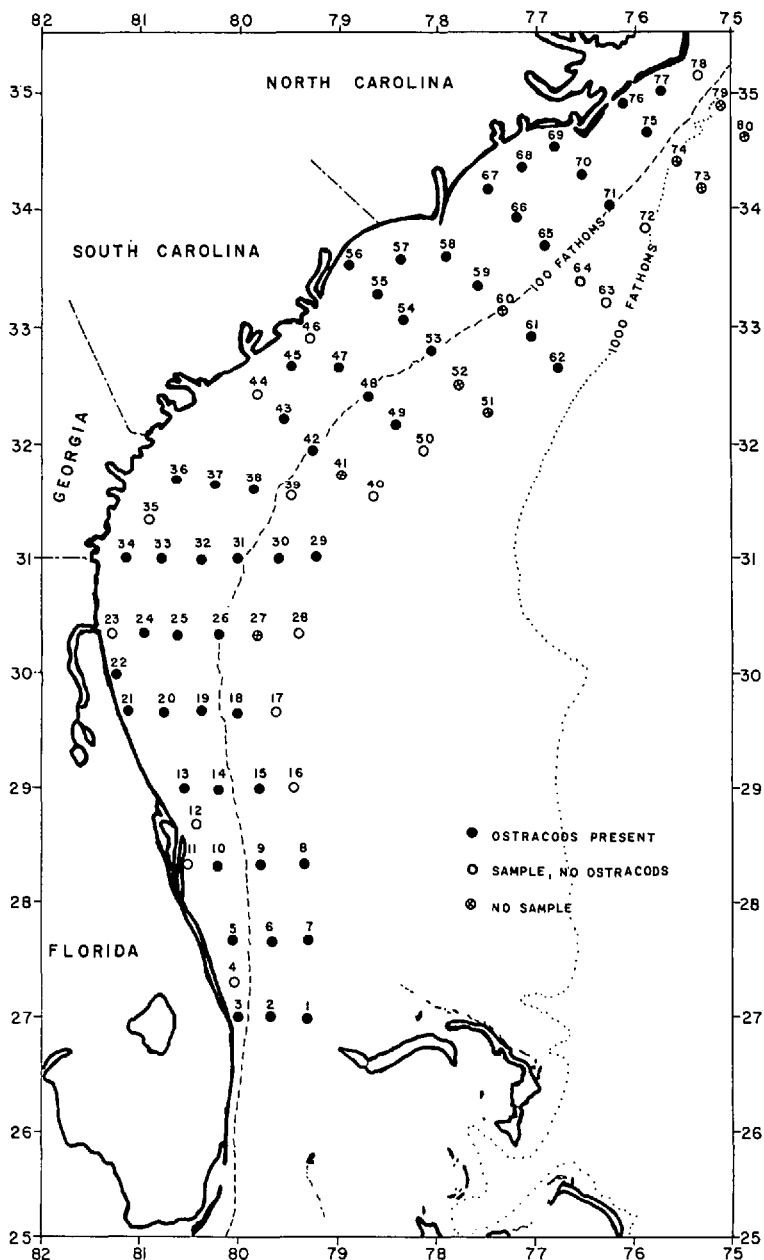


FIGURE 1. Location of sampling stations.

No live ostracods were recovered from the sediment samples. In fact, articulated ostracods were very rare at all of the stations. The fact that no live ostracods were collected, plus the absence of ecological data at the sediment-water interface, eliminate reliable ecological interpretation of distribution in terms of salinity and temperature. An attempt is made, however, to discuss distribution in terms of depth, since certain species exhibit certain depth ranges. It must be emphasized that such interpretation is hazardous because of possible current transport of the ostracod valves.

A total of 72 species have been identified for the area between Cape Hatteras and Jupiter Inlet. Most of the species occurred at four or fewer stations; for example, 18 species were found at only 1 station, 9 at 2 stations, 11 at 3 stations, and 13 at 4 stations. The remainder occurred as follows: 4 species at 5 stations, 5 at 7, 1 at 8, 1 at 9, 1 at 10, 4 at 11, 2 at 12, 1 at 15, 1 at 17, 1 at 24, 1 at 28, and 1 at 29.

It is a pleasure to acknowledge the invaluable assistance of James H. Baker. The author also thanks Mr. William W. Anderson, Director of the South Atlantic Fisheries Laboratory, Brunswick, Georgia, and Dr. Donn S. Gorsline, Department of Geology, University of Southern California, for providing the samples for this study. Financial support was provided by the Texas Christian University Faculty Research Committee, The Society of Sigma Xi, and the Texas Christian University Research Foundation.

PREVIOUS STUDIES

Recent studies of ostracods in the area between Cape Hatteras and Jupiter Inlet include those of Tressler (1940), Hulings (1959), Kornicker (1958, 1961 and 1963), and Darby (1965). Tressler reported eight species from the sand and beaches of Beaufort, North Carolina. Hulings (1959) was concerned with a comparison between the South Atlantic coast and the Gulf of Mexico. In the former area, two depth zones were recognized, one with a depth range of 27 to 200 feet and characterized by such genera as *Campylocythere*, *Cushmanidea*, *Cytheretta*, *Cytherura*, *Haplocytheridea*, *Hemicythere*, *Hulingsina*, *Loxoconcha*, *Paracytheridea*, *Pellucistoma* and *Puriana*. The other zone ranged from 600 to 2295 feet and was characterized by *Bairdia*, *Bythocypris*, *Cythereis*, *Cytherella*, *Echinocythereis*, *Krieh* and *Macrocypris*. It was further pointed out that the ostracod fauna of the South Atlantic coast and the Gulf of Mexico were very similar at the generic level, as would be expected.

Kornicker's studies were conducted in the Bahamas. In 1958, he reported on the ecology and taxonomy of marine ostracods, emphasizing the myodocopids. His 1961 paper was concerned with the ecology and taxonomy of Bairdiinae, reporting 13 species from the Bahamas with four new species of *Bairdia* and one new species of *Bairdoppilata*. The 1963 paper of Kornicker dealt with Bahamian Cytherellidae, and he reported four species, three of which were new.

TABLE 1
DEPTH, SEDIMENT TYPE AND DOMINANT BIOCLASTIC MATERIALS AT
EACH STATION FROM WHICH OSTRACODS WERE FOUND

Station (Cruise)	Sediment type	Bio- clastic	Depth (m)	Station (Cruise)	Sediment type	Bio- clastic	Depth (m)
1(1)	Sa	Fm	597	32(4)	Sa	Sh	36
2(6)	Sa	Fm	616	33(2)	Sa	Sh	33
3(4)	Sa	Sh	14	34(2)	Sa	Sh	14
5(1)	Sa	Sh	38	36(2)	Sa	Sh	21
5(2)	Sa	Sh	49	37(1)	Sa	Sh	32
5(4)	Sa	Sh	34	38(2)	Sa	—	45
5(6)	SiSa	Fm	37	42(2)	—	—	137
6(2)	—	—	567	42(4)	SiSa	Fm	155
6(4)	SaSi	Fm	543	42(5)	—	—	106
7(6)	SiSa	Fm	549	43(2)	Sa	Sh	31
8(2)	—	—	795	45(2)	Sa	Sh	15
9(2)	—	—	374	47(2)	Sa	Sh	29
9(4)	—	—	374	48(4)	SiSa	Fm	201
9(6)	—	—	476	48(5)	—	—	238
10(2)	SiSa	Sh	36	49(4)	SaSh	Fm	332
10(5)	Sa	Sh	31	53(7)	SiGrSa	Fm	73
10(6)	Sa	Sh	38	54(5)	Sa	Sh	29
13(2)	Sa	Sh	17	55(2)	Sa	Sh	18
14(4)	Sa	Sh	60	56(2)	Sa	Sh	9
14(5)	Sa	Sh	66	57(8)	Sa	Sh	16
14(6)	Sa	Sh	62	58(2)	SiSa	Sh	20
14(7)	Sa	FmSh	60	59(4)	Sa	Sh	22
15(4)	—	—	677	61(4)	GrSa	CoFm	484
18(9)	—	—	576	62(4)	SiSa	Fm	791
19(4)	Sa	Sh	42	65(4)	Sa	Sh	40
20(4)	—	—	27	66(4)	Sa	Sh	32
21(4)	Sa	Sh	18	67(5)	GrSa	Sh	18
22(4)	Sa	Sh	12	68(2)	GrSa	Sh	20
24(4)	Sa	Sh	29	69(5)	Sa	Sh	18
25(4)	Sa	—	31	70(5)	Sa	Sh	26
26(4)	SiSa	FmSh	201	71(2)	—	—	118
26(5)	—	—	155	75(5)	Sa	Sh	37
29(4)	GrSa	Fm	732	76(5)	Sa	Sh	20
30(9)	SiSaGr	CoFm	585	77(5)	—	—	24
31(4)	Sa	Sh	54				

Abbreviations: Sa = sand; Si = silt; Gr = gravel; Fm = Foraminifera; Sh = shell; Co = coral.

Darby (1965) in a study of the ostracods from Sapelo Island, Georgia, and vicinity, reported 24 species, of which 6 were podocopids and 18 were myodocopids. Several of the myodocopids were described as new species.

Hulings (1966) reported 39 species from the Virginia Coast, to the north of the present study area. Some of the same species were found to occur in both areas, as is pointed out below.

FACTORS CONTROLLING OSTRACOD DISTRIBUTION

The depth of each station from which ostracods were collected is given in Table 1. The number in parentheses indicates the cruise of the GILL on which the sample was collected. The sediment type, based on size-grade distribution, and the dominant bioclastic type, both data taken from Moore & Gorsline (1960), are also given in Table 1. Moore & Gorsline also provide data on the organic contents of the sediments and conclude that they are very low over much of the shelf and outer Blake Plateau. As mentioned earlier, hydrographic data such as oxygen, temperature and salinity were usually taken at considerable distance from the bottom, so that their significance as controlling factors in ostracod distribution cannot be properly evaluated. In spite of the absence of data at the sediment-water interface, however, it is safe to assume that the bottom salinity is generally high, about 34 to 36 parts per thousand; that the normal temperature pattern, including seasonal variation and decrease with increasing depth, exists; and that the bottom water is oxygenated.

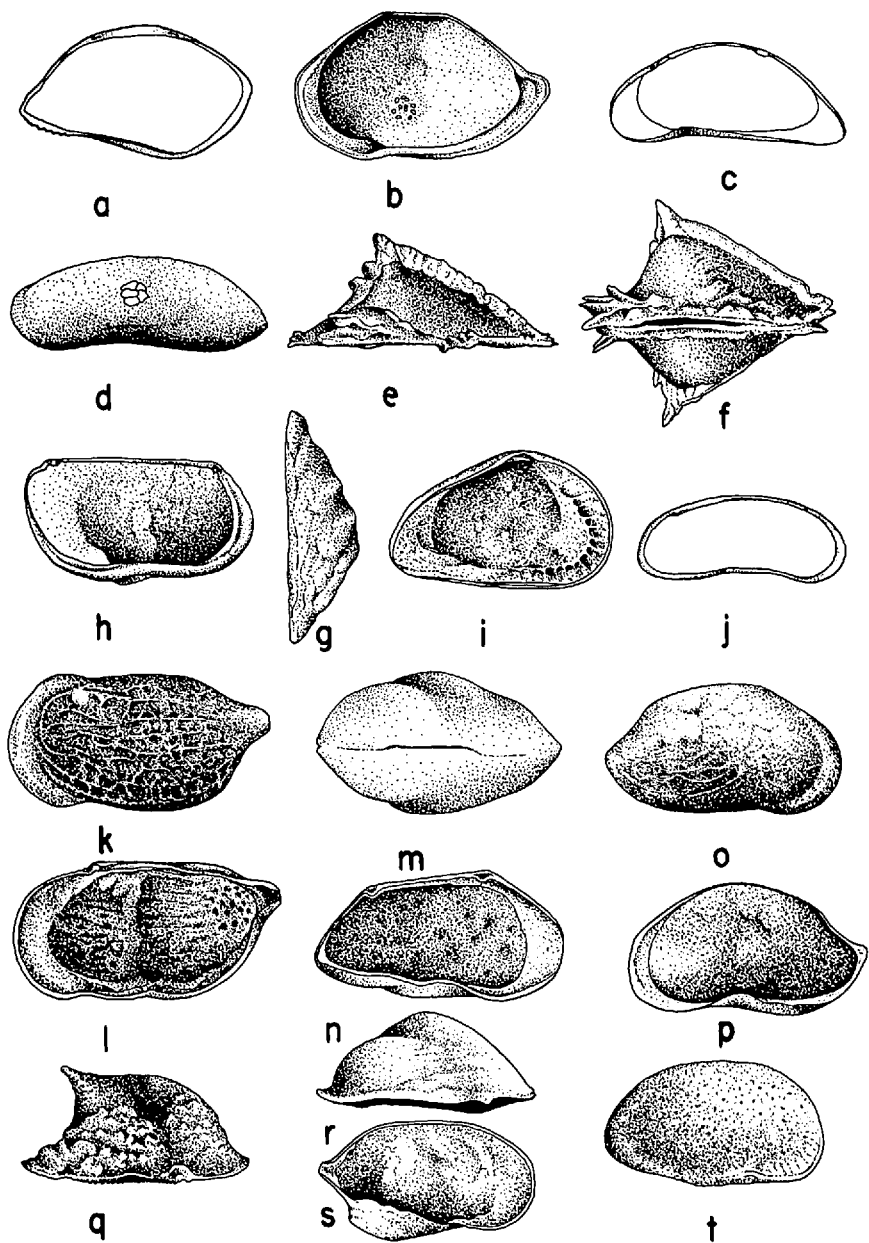
It seems, therefore, that the only environmental factors that can be evaluated with some degree of confidence are sediment type and depth. But, again, the absence of living ostracods makes these evaluations somewhat hazardous.

According to Moore & Gorsline (1960), the sediments from most of the stations where ostracods were found were predominantly sand sized, and the main bioclastic material was shell (Table 1). The ostracods reported in this paper exhibited no obvious preference for a particular type of sediment. This might be expected for dead assemblages, since the valves could be concentrated in areas of current action, *i.e.*, sand bottoms.

Three depth zones based on distribution of the species as a function of depth are recognizable. These zones are: less than 50 m, 50 to 200 m, and greater than 200 m. The species most diagnostic of each depth zone are given below. For the zone of less than 50 m, occurrence at a minimum of five stations is used to designate a species as diagnostic. Occurrence at a minimum of three stations was used for the other two assemblages. This use of differences in occurrence is justified because of the decrease in numbers of species and individuals with increasing depth.

Species diagnostic of depths < 50 m:

- Actinocythereis exanthemata* (Ulrich & Bassler)
- Aurila conradi* (Howe & McGuirt)
- Bairdia gerda* Benson & Coleman
- Cytheretta danaiana* Brady
- Cytherura gibba* (Müller)
- Cytherura pseudostrata* Hulings
- Cytherura wardensis* Howe & Brown
- Cytherura* cf. *C. forulata* Edwards
- Haplocytheridea bradyi* (Stephenson)



Loxoconcha reticularis Edwards
Pellucistoma magniventa Edwards
Pontocythere anderseni Puri
Pontocythere agricola (Howe & Hadley)
Pontocythere ashermani (Ulrich & Bassler)
Pterygocythereis cf. *P. howei* Hill
Puriana rugipunctata (Ulrich & Bassler)

Species diagnostic of depths 50 to 200 m:

Cytherella grossmani Benson & Coleman
Echinocythereis sp. A
Neocytherideis fasciata (Brady & Robertson)
Pterygocythereis americana (Ulrich & Bassler)

Species diagnostic of depths > 200 m:

Bairdia victrix Brady
Bradleya dictyon (Brady)
Bythocypris minuta Puri
Eucythere sp.
Henryhowella evax (Ulrich & Bassler)
Krithe bartonensis ? (Jones)
Macrocypris bathyalensis Hulings

The remaining species either had a very wide depth distribution or occurred at too few stations to be considered diagnostic.

The depth distribution of many of the species in the shallow water assemblage, i.e., less than 50 m, agrees closely with the depth distribution reported for the Gulf of Mexico by a number of workers including Puri & Hulings (1957), Hulings (1958), Benda & Puri (1962), Benson & Coleman (1963), and for the west coast of Florida by Hulings & Puri (1964).

Previously published works give little basis for comparison with depths beyond 50 m. Tressler (1954), however, reports several species, including *Bairdia victrix*, *Bradleya dictyon*, and *Krithe bartonensis* from the deeper parts of the Gulf of Mexico. Most of the other species reported by Tressler and by Rothwell (1949) were not found in the area covered by this paper.

SYSTEMATIC ACCOUNT

In the following account, synonymies are given only for those species that no longer are in their original genera. In addition, the species authors are

←

FIGURE 2. a, *Bairdia gerda*, internal; b, *Bairdia victrix*, internal; c, *Macrocypris* sp. cf. *M. schmitti*, internal; d, *Argilloecia acuminata*, external; e, *Pterygocythereis americana*, dorsal; f, *Pterygocythereis* sp. cf. *P. howei*, dorsal; g, *Bythocythere bifurcata*, dorsal; h, *B. bifurcata*, internal; i, *Eucythere* sp., internal; j, *Pontocythere anderseni*, internal; k, *Cytherura pseudostrata*, external; l, *C. pseudostrata*, internal; m, *Microcytherura choctawhatcheensis*, dorsal; n, *M. choctawhatcheensis*, internal; o, *Microcytherura fulva*, external; p, *M. fulva*, internal; q, *Paracytheridea toleri*, dorsal; r, *Semicytherura* sp. cf. *S. acuticostata*, dorsal; s, *S.* sp. cf. *S. acuticostata*, internal; t, *Acuticythereis laevisissima*, external.

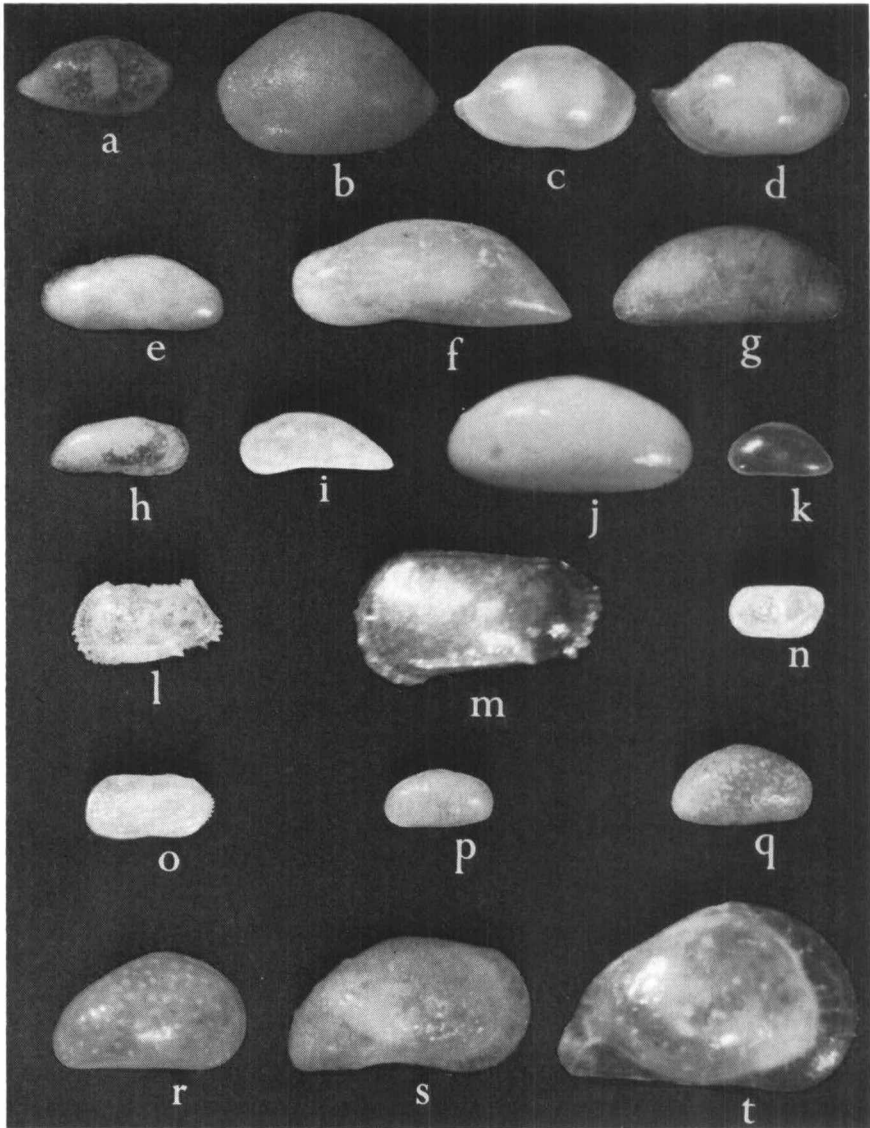


FIGURE 3. a, *Bairdia gerda* Benson & Coleman $\times 40$; b, *Bairdia harpago* Kornicker $\times 40$; c, *Bairdia victrix* Brady $\times 40$; d, *Bairdia victrix* Brady $\times 40$; e, *Bythocypris minuta* Puri $\times 100$; f, *Macrocypris bathyalensis* n. sp. $\times 40$; g, *Macrocypris* sp. cf. *M. schmitti* Tressler $\times 40$; h, *Macrocypris* sp. $\times 40$; i, *Paracypris choctawhatcheensis* Puri $\times 40$; j, *Propontocypris howei* (Puri) $\times 100$; k, *Propontocypris* sp. $\times 40$; l, *Pterygocythereis americana* (Ulrich & Bassler) $\times 40$; m, *Pterygocythereis* sp. cf. *P. howei* Hill $\times 100$; n, *Bythocythere bifurcata*

included in the literature citation. The listing of the species within a genus is alphabetical and does not imply a specific phylogeny. In certain instances the depth is given in parentheses following the station, because several samples were collected at one station and the depth varied.

Order *PODOCOPIDA* Müller, 1894

Suborder *PODOCOPINA* Sars, 1866

Superfamily *BAIRDIACEA* Sars, 1888

Family *Bairdiidae* Sars, 1888

Genus *Bairdia* McCoy, 1844

Bairdia gerda Benson & Coleman, 1963

Figs. 2a, 3a

This species was found at stations 31, 36, 43, 54, and 58. The depth range was 20 to 36 m. Benson & Coleman (1963) reported *B. gerda* as very abundant at depths less than 50 feet in the eastern Gulf of Mexico.

Bairdia harpago Kornicker, 1961

Fig. 3b

Recovered from four stations, 1, 19, 49, and 55, over a depth range of 18 to 597 m. Kornicker (1961) reported *B. harpago* from a depth range of 1 to 28 m in the Bahamas. He suggested, however, that this species might be more abundant in deeper waters. The occurrence reported here tends to support Kornicker's suggestion, as three of the four stations were deeper than 28 m.

Bairdia victrix Brady, 1867

Figs. 2b, 3c, d

Specimens of this species were compared with Brady's *B. victrix* from the British Museum. The muscle scars, general shape and other features compared very closely with Brady's specimens. This species is the most typical and widespread deep water species. It occurred at stations 1, 2, 6 (567 m), 8, 15, 18, 19, 29, 42 (155 m), and 61, and ranged in depth from 155 to 777 m.

Genus *Bythocypris* Brady, 1880

Bythocypris minuta Puri, 1953

Fig. 3e

This species was originally described from the Miocene of Florida by Puri (1953). Comparison of the fossils and the specimens from stations

←

(Puri) $\times 40$; o, *Cytheretta danaiana* (Brady) $\times 40$; p, *Haplocytheridea bradyi* (Stephenson) $\times 40$; q, *Haplocytheridea setipunctata* (Brady) $\times 40$; r, *Eucythere declivis* (Norman) $\times 100$; s, *Eucythere triangulata* Puri $\times 100$; t, *Eucythere* sp. $\times 100$.

2, 6 (543 and 567 m), and 48 (201 m), reveal no specific differences. *B. minuta* is considered another deep water species, and was recovered from a depth range of 201 to 616 m.

Family Macrocyprididae Müller, 1912

Genus *Macrocypris* Brady, 1867

***Macrocypris bathyalensis*, n. sp.**

Figs. 4r, s, t, u; 3f

Diagnosis.—Shell elongate and narrow. Greatest height in the larger right valve about one-third from posterior end. From point of greatest height, dorsal surface slopes gently to the broadly rounded anterior end. Ventral surface concave at a point about one-third the way from the anterior end.

Left valve smaller and narrower than right. Length to height ratio averages 2.6:1 in left valves and 2.35:1 in right valves. Dorsal margin concave near the anterior end, then curving gently up to the point of greatest height, then gently down to a point about one-fourth the way from the posterior end where the slope becomes steep. The ventral surface is much more concave than the right valve.

Surface of valves smooth; hinge normal for the genus. The left valve, in dorsal view, characterized by a conspicuous indentation anterior to the anterior crenulated hinge element followed by a projecting element. Hinge of the left valve is the complement of the right. Marginal pore canals sparse and give the appearance of the branching type (five groups with the two ventral-most the largest), especially on the anterior end. Central muscle scar composed of twelve individual scars with three located dorsally and aligned anterior-posteriorly. The remaining scars occur ventrally. Inner lamella normal. The appendages of two specimens of *Macrocypris bathyalensis* sp. n. from 57°50'N, 58°01'W in the North Atlantic were in a deteriorated condition so that little could be done with them. The basic structure of the antennula, antenna, and the third thoracic leg, however, seem to be normal for the genus.

Remarks.—The left valve of *M. bathyalensis* sp. n. resembles *M. tenuicauda* Brady, 1880, but differs in the absence of the slightly upturned dorsal portion of the anterior end. There is little comparison in the shape of the right valve of the two species. *M. bathyalensis* differs from *M. minna* (Baird, 1850) in shape of both valves. Darby (1965) described *Macrocypris sapeloensis* from two localities in the vicinity of Sapelo Island, Georgia, one at a depth of 625 feet. Comparison of the holotype of *M. sapeloensis* with *M. bathyalensis* reveals a difference in the shapes of both valves, especially the dorsal surfaces. The central muscle scar pattern also differs, as does size, with the latter species being larger. The right valve illustrated by Tressler (1942) belongs to *M. bathyalensis*.

The holotype is deposited in the American Museum of Natural History.

Measurements.—Left valves range from 1.67 to 1.80 mm in length, and 0.6 to 0.7 mm in height. Right valves are between 1.70 and 1.85 mm long, and 0.7 to 0.8 mm high.

Occurrence.—*M. bathyalensis* was found at four stations, 15 (667 m), 18 (576 m), 30 (585 m), and 48 (201 m). Two live females of this species were found at 57°50'N, 58°01'W at a depth of 3369 m. All of the specimens found between Cape Hatteras and Jupiter Inlet, however, were dead.

Macrocypis sp. cf. *M. schmitti* Tressler, 1949

Figs. 2c, 3g

Specimens of this species were found at five stations, namely, 6 (567m), 14 (60 m), 45, 49, and 65. In addition to being widely distributed geographically within the area studied, the species also had a wide depth range, 15 to 567 m.

Superfamily CYPRIDACEA Baird, 1845

Family Paracyprididae Sars, 1923

Genus *Paracypris* Sars, 1866

Paracypris choctawhatcheensis Puri, 1953

Fig. 3i

Puri (1953) described this species from the Miocene of Florida. Specimens virtually identical with the Miocene species were found at stations 14 (60 m), 26 (155 and 201 m), and 42 (137 m).

Family Pontocyprididae Müller, 1894

Genus *Argilloecia* Sars, 1866

Argilloecia acuminata Müller, 1894

Fig. 2d

A. acuminata, originally described from the Bay of Naples, was restricted to the southern part of the area under consideration. It was found at two stations, 5 (37 m) and 9 (476 m).

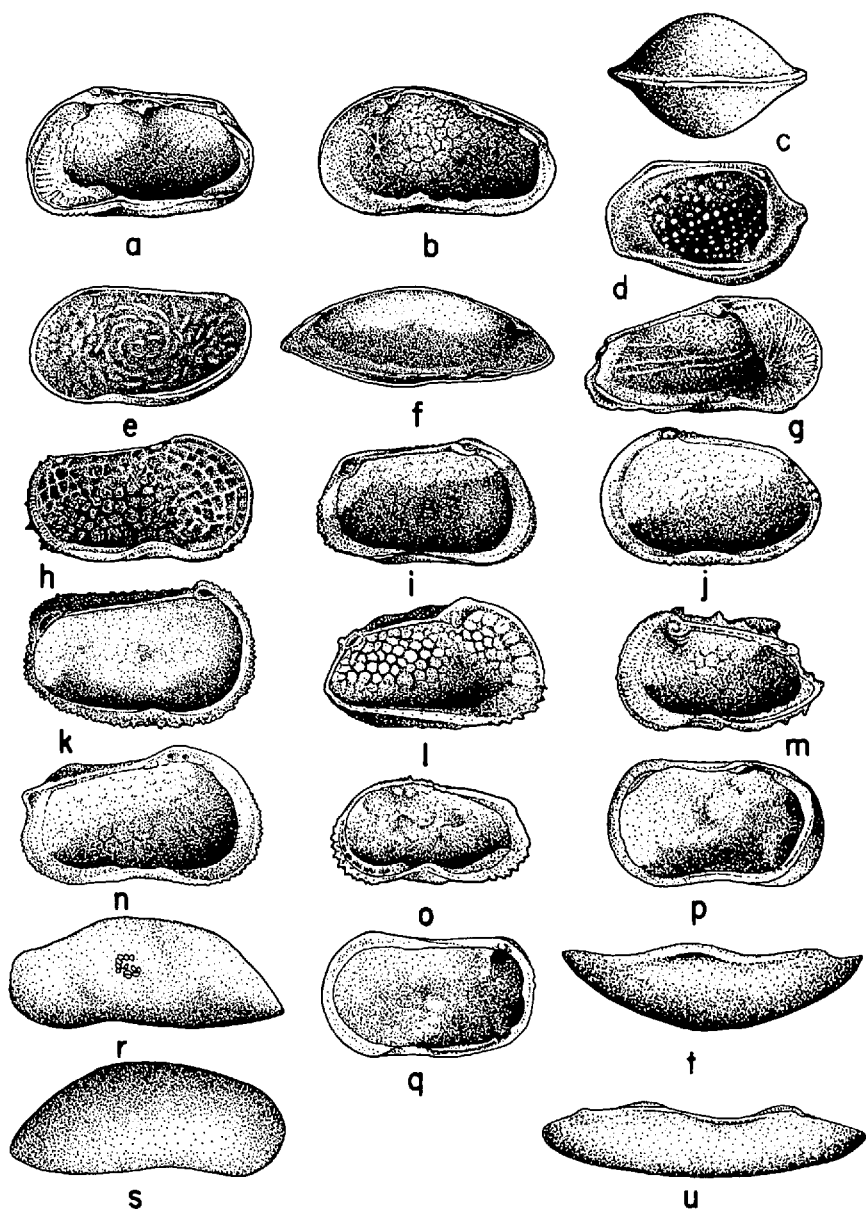
Genus *Propontocypris* Sylvester-Bradley, 1947

Propontocypris howei (Puri), 1953

Fig. 3j

Bythocypris howei Puri, 1953, p. 226, pl. 1, figs. 14-16, text figs. 2e-g.

P. howei was reported from the coast of Virginia by Hulings (1966) from a depth range of 20 to 34 m. In the area between Cape Hatteras and



Jupiter Inlet, this species was found at five stations, 5 (49 m), 14 (60 m), 31, 42 (137 and 155 m), and 47, covering a depth range of 29 to 155 m. *P. howei* is another species originally described from the Miocene of Florida by Puri (1953).

Propontocypris sp.

Fig. 3k

This species of *Propontocypris* was found at stations 10 and 42. The depths were 36 and 137 m, respectively.

Superfamily CYTHERACEA Baird, 1850

Family Brachycytheridea Puri, 1953

Genus *Pterygocythereis* Blake, 1933

Pterygocythereis americana (Ulrich & Bassler, 1904)

Figs. 2e, 3l

Pterygocythereis cornuta var. *americana* Ulrich & Bassler, 1904, p. 122, pl. 37, figs. 29-33.

Pterygocythereis americana (Ulrich & Bassler) van den Bold, 1950, p. 83.

P. americana was found at four stations, 14 (60 m), 26 (155 and 201 m), 42 (106 m), and 48 (238 m), covering a depth range of 60 to 238 m. Benson & Coleman (1963) reported this species from a depth range of 19 to 239 ft, from the eastern Gulf of Mexico.

Pterygocythereis sp. cf. *P. howei* Hill, 1954

Figs. 2f, 3m

P. howei was originally described from the Oligocene of Mississippi by Hill (1954). The specimens from the area under consideration do not differ greatly from *P. howei*. This species exhibited a wide geographic range in

←

FIGURE 4. a, *Triginglymus denticulata*, internal; b, *Cytheromorpha protapheles*, internal; c, *Loxoconcha banesensis*, dorsal; d, *L. banesensis*, internal; e, *Loxoconcha reticularis*, internal; f, *Xiphichilus* sp. cf. *X. flexuosa*, internal; g, *Amboocythere* sp., internal; h, *Bradleya dictyon*, internal; i, *Echinocythereis* sp. A, internal; j, *Echinocythereis* sp. B, internal; k, *Henryhowella evax*, internal; l, *Hermanites reticulata*, internal; m, *Jugosocythereis* sp. cf. *J. vicksburgensis*, internal; n, *Murrayina canadensis*, internal; o, *Neocaudites triplistriata*, internal; p, *Cytherelloidea praecipua*, internal; q, *Cytherelloidea sarsi*, internal; r, *Macrocypris bathyalensis*, holotype, female, left valve; s, *M. bathyalensis*, holotype, female, right valve; t, *M. bathyalensis*, dorsal view of left valve; u, *M. bathyalensis*, dorsal view of right valve.

the area, occurring at stations 5 (34 m), 10 (36 m), 14 (60 m), 24, 26 (155 m), 42 (137 and 155 m), 54, and 75, with a depth range of 29 to 155 m. Most of the specimens came from a depth range of 29 to 60 m.

Family Bythocytheridea Sars, 1926

Genus *Bythocythere* Sars, 1866

Bythocythere bifurcata (Puri), 1953

Figs. 4g, h; 3n

Monoceratina bifurcata Puri, 1953, p. 295, pl. 15, figs. 6-10, text figs. 12 k-m.

B. bifurcata was found at two stations, 14 (60 m) and 54 (29 m). This species is another originally described from the Miocene of Florida.

Bythocythere sp.

Only one specimen was found, that being at station 26 at a depth of 155 m.

Family Cytherettidae Triebel, 1952

Genus *Cytheretta* Müller, 1894

Cytheretta danaiana (Brady), 1869

Fig. 3o

Cythere danaiana Brady, 1869, p. 124, pl. 14, figs. 13-14.

C. danaiana exhibited a wide geographic distribution in shallow water (22 to 60 m) in the area between Cape Hatteras and Jupiter Inlet. It was found at seven stations, including 5 (34 m), 10 (31 and 36 m), 14, 42 (60 and 66 m), 59, 70, and 77. Hulings (1966) reported this species from the Virginia coast. It has also been reported from the Gulf of Mexico and Caribbean by several workers.

Family Cytherideidae Sars, 1925

Subfamily Cytherideinae Sars, 1925

Haplocytheridea bradyi (Stephenson), 1938

Fig. 3p

Cytheridea bradyi Stephenson, 1938, p. 129, pl. 23, fig. 22; pl. 24, figs. 5, 6; text fig. 10.

This species was one of the more common and widespread forms in the area between Cape Hatteras and Jupiter Inlet. It occurred at 12 stations, including 3, 5 (34 and 38 m), 19, 20, 21, 33, 36, 56, 57, 67, 70, and 77. In addition to being common and widespread, *H. bradyi* occurred in a narrow depth range, 9 to 42 m. Hulings (1966) reported this species from the Virginia coast.

Haplocytheridea setipunctata (Brady), 1869

Fig. 3q

Cytheridea setipunctata Brady, 1869, p. 124, pl. 14, figs. 15-16.

This large species of *Haplocytheridea* exhibited a restricted geographic range, occurring at only three localities, stations 3, 5 (49 m), and 10 (36 m), in the southern part of the study area. The depth range was 14 to 49 m.

Subfamily Eucytherinae Puri, 1953

Genus *Eucythere* Brady, 1868*Eucythere declivis* (Norman), 1865

Fig. 3r

Cythere declivis Norman, 1865, p. 16, pl. 5, figs. 9-12.

Found at only one station, 10, at a depth of 36 m. Hulings (1966) reported this species from the coast of Virginia.

Eucythere triangulata Puri, 1953

Fig. 3s

E. triangulata, a Miocene species, was found at stations 5 and 14, at depths of 49 and 60 m, respectively.

Eucythere sp.

Figs. 2i, 3t

This species of *Eucythere* was restricted to deeper water, the depth range being 201 to 476 m. It was found at stations 9 (476), 26 (201 m), and 48 (201 m), and is considered one of the true deep water species.

Subfamily Krithinae Mandelstam in Bubikan, 1958

Genus *Krithe* Brady, Crosskey & Robertson, 1874*Krithe bartonensis* (Jones), 1856

Fig. 5a

Cytherideis bartonensis Jones, 1856, p. 50, pl. 5, figs. 2a-b, 3a-b.

It is evident that the genus *Krithe* needs to be restudied. For the present, specimens from stations 7 (549 m), 15 (677 m), and 48 (201 m) are considered to be *K. bartonensis*. Tressler (1949) reported this species from deep water in the North Atlantic. Neale (1964) has pointed out that the distribution of *K. bartonensis* corresponds exactly with the path of the Gulf Stream and the North Atlantic Drift. This species is considered a typical deep water form.

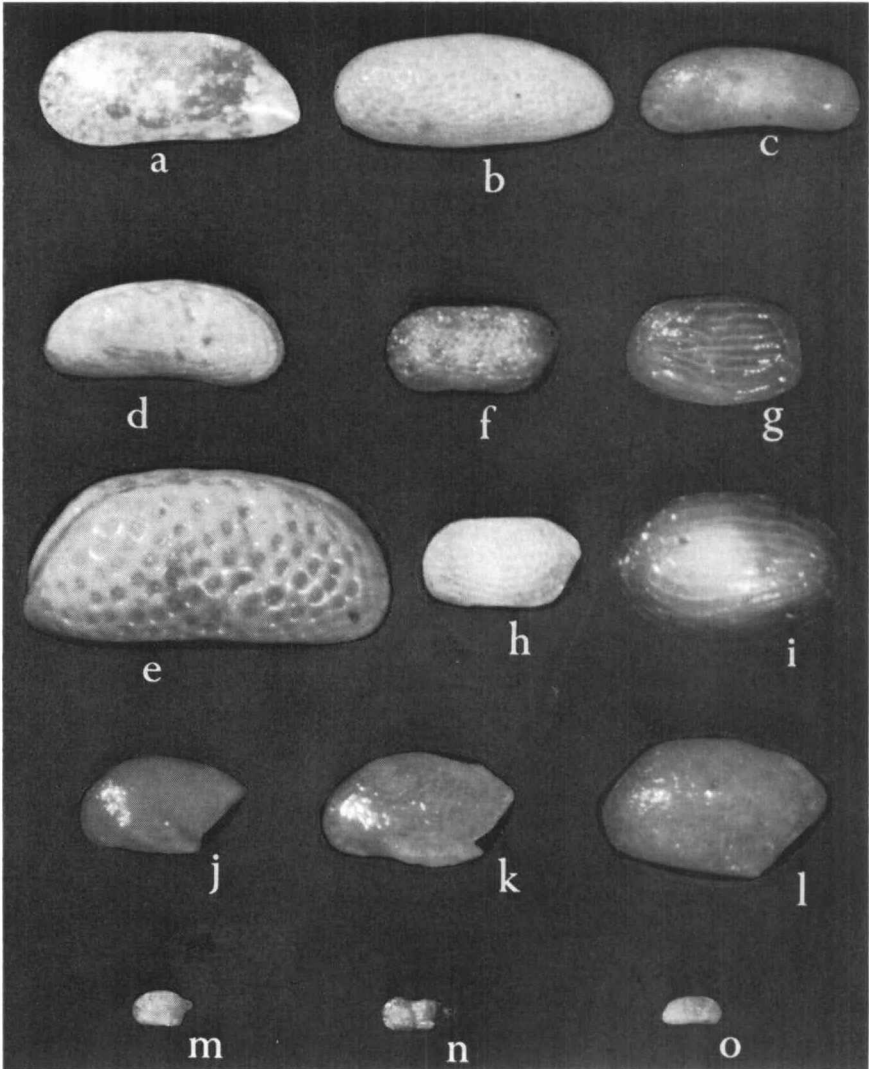


FIGURE 5. a, *Krithe bartonensis* (Jones) $\times 100$; b, *Neocytherideis fasciata* (Brady & Robertson) $\times 100$; c, *Pontocythere anderseni* (Puri) $\times 100$; d, *Pontocythere agricola* (Howe & Hadley) $\times 100$; e, *Pontocythere ashermani* (Ulrich & Bassler) $\times 100$; f, *Cytherura gibba* (Müller) $\times 100$; g, *Cytherura pseudo-striata* Hulings $\times 100$; h, *Cytherura wardensis* Howe & Brown $\times 100$; i, *Cytherura* sp. cf. *C. forulata* Edwards $\times 100$; j, *Cytheropteron alatum* ? Sars $\times 100$; k, *Cytheropteron spinosum* Martin $\times 100$; l, *Cytheropteron talquinensis* Puri $\times 100$; m, *Microcytherura fulva* (Brady & Robertson) $\times 40$; n, *Paracytheridea toleri* (Howe & Law) $\times 40$; o, *Semicytherura* sp. cf. *S. acuticostata* (Sars) $\times 40$.

Subfamily Neocytherideidinae Puri, 1957

Genus *Neocytherideis* Puri, 1952

Neocytherideis fasciata (Brady & Robertson), 1874

Fig. 5b

Cytherideis subulata var. *fasciata* Brady & Robertson, 1874, p. 55, pl. 1, figs. 12-13.

This species was restricted to the more northern parts of the area studied, stations 42 (155 m), 49, 53, and 70, and was found over a considerable depth range of 26 to 332 m. Hulings (1966) reported living *N. fasciata* from the Virginia coast over a depth range of 22 to 38 m.

Genus *Pontocythere* Dubowsky, 1939

Pontocythere anderseni (Puri), 1952

Figs. 2j, 5c

Cytherideis anderseni Puri, 1952, p. 908, pl. 130, figs. 15-17, text figs. 9-10.

P. anderseni, originally described from the Miocene of Florida, was found at 11 stations, including 1, 5 (34 m), 10 (36 m), 20, 24, 26 (155 m), 33, 34, 42 (137 m), 49, and 65, covering a depth range of 14 to 332 m.

Pontocythere agricola (Howe & Hadley), 1935

Fig. 5d

Cytherideis agricola Howe & Hadley, in Howe, et al., 1935, p. 13, pl. 3, figs. 27-30; pl. 4, fig. 8.

This species of *Pontocythere* was found at 17 different stations, including 14 (60 m), 19, 20, 22, 24, 33, 36, 45, 47, 49, 54, 55, 58, 65, 66, 70, and 76. The depth range was 12 to 332 m, with most of the specimens occurring at a depth of less than 40 m. Hulings (1966) reported *P. agricola* from the coast of Virginia.

Pontocythere ashermani (Ulrich & Bassler), 1904

Fig. 5e

Cytherideis ashermani Ulrich & Bassler, 1904, p. 126, pl. 37, figs. 10-16.

P. ashermani was the most widely distributed ostracod of all the species recovered from the study area. It occurred at a total of 29 stations, and ranged in depth from 18 to 332 m. Most of the specimens occurred at depths of less than 40 m. This species was previously reported alive from the Virginia coast by Hulings (1966).

Family Cytheruridae Müller, 1894

Genus *Cytherura* Sars, 1866*Cytherura gibba* (Müller), 1785

Fig. 5f

Cythere gibba Müller, 1785, p. 24, pl. 7, figs. 10-12.

C. gibba was found at 11 widely distributed stations covering a depth range of 12 to 374 m. Most of the specimens occurred in depths of less than 40 m. Hulings (1966) reported this European species from the coast of Virginia. Tressler & Smith (1948) also reported *C. gibba* from the Atlantic Coast of North America.

Cytherura pseudostrata Hulings, 1966

Figs. 2k, l; 5g

This species, originally described from the coast of Virginia, was also widely distributed. It occurred at 11 stations covering a depth range of 18 to 118 m. Ten of the 11 stations, however, were shallower than 49 m.

Cytherura wardensis Howe & Brown, 1935

Fig. 5h

C. wardensis was found to be another shallow water species in the area between Cape Hatteras and Jupiter Inlet, occurring at 10 localities, nine of which were shallower than 60 m. This species was also widely distributed geographically, ranging from station 5 to station 70. Hulings (1966) reported this species from the Virginia coast.

Cytherura sp. cf. *C. forulata* Edwards, 1944

Fig. 5i

This was the most abundant species of *Cytherura* found in the area between Cape Hatteras and Jupiter Inlet. It occurred at 24 stations covering a depth range of 18 to 201 m. Most of the stations, however, were less than 40 m deep. Thus, all of the species of *Cytherura* were found to be typically shallow water.

Genus *Cytheropteron* Sars, 1866*Cytheropteron alatum* ? Sars, 1866

Fig. 5j

C. alatum was found only at station 42, at a depth of 137 m.

Cytheropteron spinosum Martin, 1939

Fig. 5k

This species was also found at only one locality, station 9, at a depth of 476 m.

Cytheropteron talquinensis Puri, 1953

Fig. 51

The third species of *Cytheropteron* was found only at station 42 (106, 137, and 155 m).

Genus *Microcytherura* Müller, 1894*Microcytherura choctawhatcheensis* (Puri), 1953

Figs. 2m, n; 6a

Cytheropteron choctawhatcheensis Puri, 1953, p. 242, pl. 5, figs. 1-2.

This species of *Microcytherura*, originally described from the Miocene of Florida, was found at stations 5 (34 m), 10 (31 and 36 m), 14 (60 m), and 26 (155 and 201 m), covering a depth range of 34 to 201 m. Hulings (1966) reported this species from the coast of Virginia.

Microcytherura fulva (Brady & Robertson), 1874

Figs. 2o, p; 5m

Cytherura fulva Brady & Robertson, 1874, p. 116, pl. 4, figs. 1-5.

M. fulva was found at only one station, 21, at a depth of 18 m. Hulings (1966) reported this species also from the Virginia coast.

Genus *Paracytheridea* Müller, 1894*Paracytheridea toleri* Howe & Law, 1936

Figs. 2q, 5n

This species was found at stations 14 (60 m), 19 (42 m), 24 (29 m), and 42 (106 m).

Paracytheridea washingtonensis Puri, 1953

P. washingtonensis was found at stations 10 (31 m), 14 (60 m), 19, 26 (155 m), 31, 42 (155 m), and 48 (201 m). The depth at these stations ranged from 31 to 201 m.

Genus *Semicytherura* Wagner, 1957*Semicytherura* sp. cf. *S. acuticostata* (Sars), 1866

Figs. 2r, s; 5o

Cytherura acuticostata Sars, 1866, p. 76-77.

This European species was found at stations 26 and 42, in a depth range of 137 to 201 m.

Family Hemicytheridae Puri, 1953

Genus *Aurila* Pokorny, 1955*Aurila amygdala* (Stephenson), 1944

Hemicythere amygdala Stephenson, 1944, p. 158, pl. 28, figs. 8-9.

A. amygdala was found at station 5 only, at a depth of 49 m.

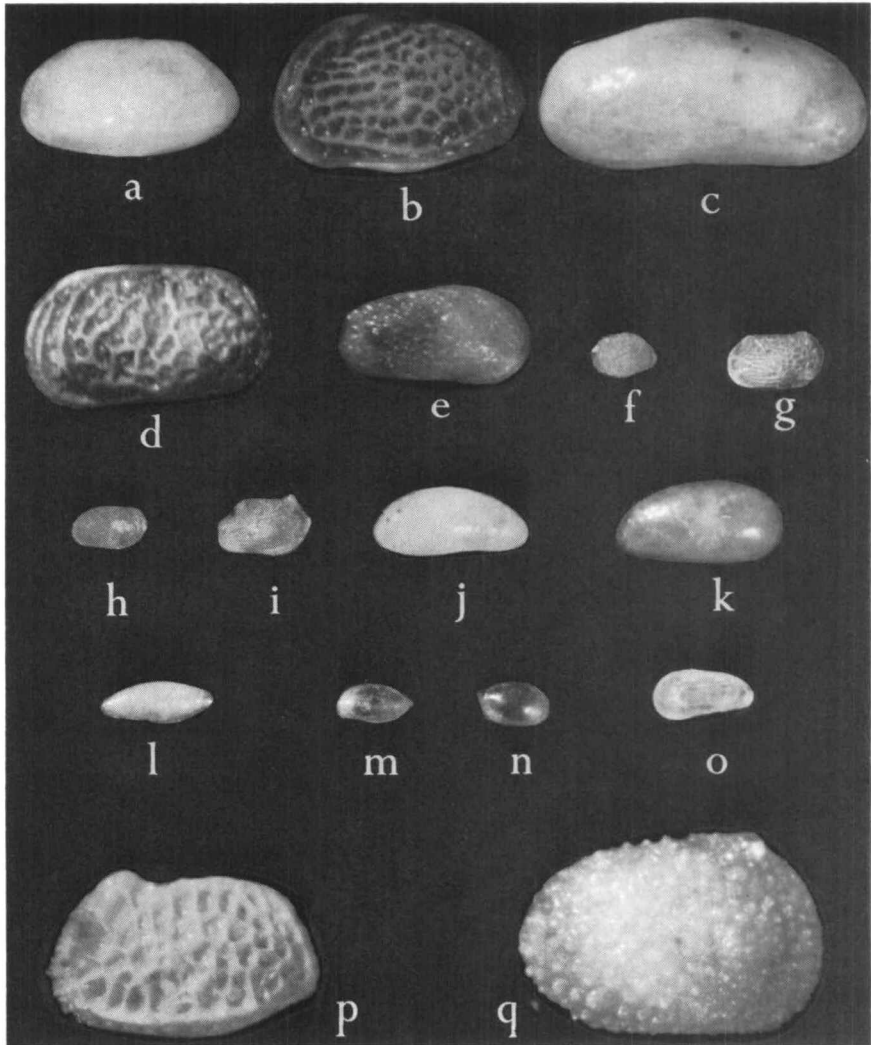


FIGURE 6. a, *Microcytherura choctawhatcheensis* (Puri) $\times 100$; b, *Aurila conradi* (Howe & McGuirt) $\times 100$; c, *Campylocythere laeva* Edwards $\times 100$; d, *Triginglymus denticulata* Hulings $\times 100$; e, *Cytheromorpha protapheles* van den Bold $\times 100$; f, *Loxoconcha banesensis* van den Bold $\times 40$; g, *Loxoconcha fischeri* (Brady) $\times 40$; h, *Loxoconcha reticularis* (Edwards) $\times 40$; i, *Loxoconcha* sp. $\times 40$; j, *Cytherois fischeri* (Sars) $\times 100$; k, *Paradoxostoma* ? *delicata* Puri $\times 100$; l, *Xiphichilus* sp. cf. *X. flexuosa* (Brady) $\times 40$; m, *Pellucistoma magniventra* Edwards $\times 40$; n, *Pellucistoma tumidum* Puri $\times 40$; o, *Ambocythere* sp. $\times 40$; p, *Bradleya dictyon* (Brady) $\times 100$; q, *Echinocythereis garretti* (Howe & McGuirt) $\times 40$.

Aurila conradi (Howe & McGuirt), 1935

Fig. 6b

Hemicythere conradi Howe & McGuirt, in Howe, *et al.*, 1935, p. 27, pl. 3, figs. 31-34; pl. 4, fig. 17.

A. conradi was found at 15 stations, the southernmost being station 19, and the northernmost, 71. The depth range was 18 to 332 m, although most of the specimens were found at depths less than 40 m. Hulings (1966) reported *A. conradi* from the coast of Virginia. This species has also been reported from the Gulf of Mexico, by numerous investigators. It would appear that this is a typical, widely distributed, shallow-water species.

Family Camylocytheridae Puri, 1960

Genus *Acuticythereis* Edwards, 1944

Acuticythereis laevissima ? Edwards, 1944

Fig. 2t

This species occurred at four stations, 5 (34 m), 36 (21 m), 49 (332 m), and 59 (22 m).

Genus *Basslerites* Howe, in Coryell & Fields, 1937

Basslerites miocenicus (Howe), 1935

Basslerella miocenia Howe, 1935, p. 31, pl. 1, figs. 19, 24, 26.

B. miocenicus was found at stations 1, 5 (34, 37, and 49 m), 14 (60 m), and 42 (137 m). The depth range of these stations was 34 to 597 m.

Genus *Campylocythere* Edwards, 1944

Campylocythere laeva Edwards, 1944

Fig. 6c

Hulings (1966) reported this species from the coast of Virginia. In the area between Cape Hatteras and Jupiter Inlet, *C. laeva* was found at seven stations, 9, 36, 38, 42 (155 m), 45, 48 (201 m), and 49. The depth ranged from 15 to 374 m. Four of the seven stations at which this species occurred exceeded 100 m, including 9 (374 m), 42 (155 m), 48 (201 m), and 49 (332 m). It would appear, therefore, that *C. laeva* has a wide bathymetric distribution, assuming that the distribution of the dead valves is an indication of its true distribution.

Genus *Tringlymus* Blake, 1950

Tringlymus denticulata Hulings, 1966

Figs. 4a, 6d

T. denticulata was found at nine stations, including 5 (34 m), 10 (31 and 36 m), 14 (60 m), 26 (155 and 201 m), 31, 42 (137 and 155 m),

43, 56, and 65. The depth ranged from 9 to 201 m, although most of the specimens were found at depths of less than 60 m. This distribution is in good agreement with that found for the live specimens off the coast of Virginia by Hulings (1966).

Family Loxoconchidae Sars, 1925

Genus *Cytheromorpha* Hirschmann, 1909

Cytheromorpha protapheles van den Bold, 1963

Figs. 4b, 6e

This species was restricted to the southern end of the study area. It was found at stations 1, 5 (34, 37, and 49 m), 10 (36 and 38 m), and 14 (60 m). It was most common at depths of less than 60 m.

Genus *Loxoconcha* Sars, 1866

Loxoconcha banesensis van den Bold, 1946

Figs. 4c, d; 6f

L. banesensis occurred at three stations located in the southernmost part of the area, namely 1, 5 (34, 37, and 49 m), and 14 (60 m).

Loxoconcha fischeri (Brady), 1869

Fig. 6g

Cythere fischeri Brady 1869, p. 154, pl. 18, figs. 15-16.

This species was found at only one station, 14, at a depth of 60 m.

Loxoconcha reticularis Edward, 1944

Figs. 4e, 6h

L. reticularis was the most abundant and widely distributed species of *Loxoconcha* found in the study area. It occurred at 11 stations ranging in a south to north direction from station 1 to station 65. The depth range was 12 to 238 m, with most of the specimens occurring at depths of less than 50 m.

Loxoconcha sp.

Fig. 6i

This unidentified species of *Loxoconcha* was found at only one station, 38, at a depth of 45 m.

Family Paradoxostomatidae Brady & Norman, 1889

Subfamily Paradoxostomatinae Brady & Norman, 1889

Genus *Cytheroïs* Müller, 1884

Cytheroïs fischeri (Sars), 1866

Fig. 6j

Paradoxostoma fischeri Sars, 1866, p. 96-97.

Specimens here designated as *C. fischeri* appear to be identical with

Sars's *C. fischeri*. This species was found at only one station, 5, at a depth of 34 m.

Genus *Paradoxostoma* Fischer, 1855

Paradoxostoma ? *delicata* Puri, 1953

Fig. 6k

A species with a restricted geographic occurrence, *P.* ? *delicata* was found only at station 5, at a depth of 41 m.

Genus *Xiphichilus* Brady, 1870

Xiphichilus sp. cf. *flexuosa* (Brady), 1866

Figs. 4f, 6l

Paradoxostoma flexuosum Brady, 1866, p. 461, pl. 35, figs. 30-34.

This species was restricted to stations 1, 5 (49 m), and 42 (137 m). The depth range of these stations was 38 to 137 m.

Subfamily Cytheromatinae Elofson, 1939

Genus *Pellucistoma* Coryell & Fields, 1937

Pellucistoma magniventra Edwards, 1944

Fig. 6m

P. magniventra occurred at seven stations, all of which were widely distributed (5, 34, 58, 69, 70, 75, and 76). The depth range of these stations was 14 to 38 m. This species, therefore, is a typical shallow-water form.

Pellucistoma tumidum Puri, 1953

Fig. 6n

Unlike *P. magniventra*, *P. tumidum* was very restricted, occurring at only one station, 14, at a depth of 60 m.

Family Trachyleberididae Sylvester-Bradley, 1948

Genus *Ambocythere* van den Bold, 1957

Ambocythere sp.

Figs. 4g, 6o

This species occurred at only two stations, 7 (549 m), and 42 (106 m).

Genus *Bradleya* Hornibrook, 1952

Bradleya dictyon (Brady), 1880

Figs. 4h, 6p

Cythere dictyon Brady, 1880, p. 99, pl. 24, figs. 1a-y.

Specimens of *Bradleya dictyon* from the study area were compared with Brady's *Cythere dictyon* from the British Museum. While Brady's *C. dictyon*

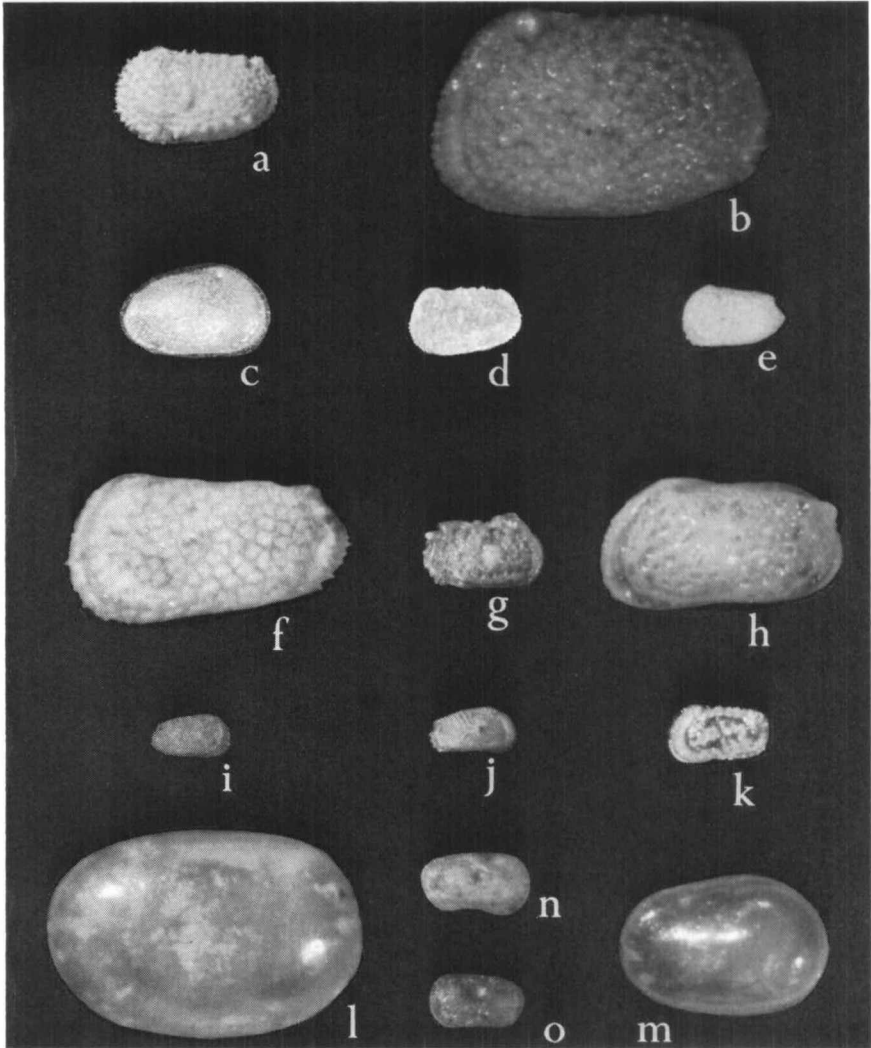


FIGURE 7. a, *Echinocythereis* sp. cf. *E. acanthoderma* (Brady) $\times 40$; b, *Echinocythereis* sp. A $\times 100$; c, *Echinocythereis* sp. B $\times 40$; d, *Henryhowella evax* (Ulrich & Bassler) $\times 40$; e, *Hermanites reticulata* Puri $\times 40$; f, *Hermanites* sp. cf. *H. wyvillethomsoni* (Brady) $\times 100$; g, *Jugosocythereis* sp. cf. *J. vicksburgensis* (Howe & Law) $\times 40$; h, *Murrayina canadensis* (Brady) $\times 100$; i, *Neocaudites triplistriata* (Edwards) $\times 40$; j, *Puriana rugipunctata* (Ulrich & Bassler) $\times 40$; k, *Actinocythereis exanthemata* (Ulrich & Bassler) $\times 40$; l, *Cytherella chipolensis* ? Puri $\times 100$; m, *Cytherella grossmani* Benson & Coleman $\times 100$; n, *Cytherelloidea praecipua* van den Bold $\times 40$; o, *Cytherelloidea sarsi* Puri $\times 40$.

probably includes more than one species, some of my specimens were virtually identical with specimens deposited in the British Museum. Until the type material is restudied, the specimens from the study area are designated as *B. dictyon*.

This species occurred at stations 2, 7, and 62. The depth range was 549 to 791 m. *B. dictyon*, therefore, is a typical deep-water species.

Genus *Echinocythereis* Puri, 1953

Echinocythereis sp. cf. *E. acanthoderma* (Brady)

Fig. 7a

Cythere acanthoderma Brady 1880, p. 104, pl. 15, figs. 5a-e.

This species was found at only one station, 9, at a depth of 476 m.

Echinocythereis garretti (Howe & McGuirt), 1935

Fig. 6q

Cythereis garretti Howe & McGuirt, in Howe, *et al.*, 1935, p. 20, pl. 3, figs. 17-19; pl. 4, figs. 5, 15.

E. garretti was found at four widely distributed stations, 5 (34 m), 14 (60 m), 42 (155 m), and 71. The depth ranged from 34 to 155 m. This appears to be a species of *Echinocythereis* from relatively shallow water.

Echinocythereis sp. A

Figs. 4i, 7b

The most abundant species of *Echinocythereis*, *E. sp. A.*, occurred at stations 14 (60 and 66 m), 15, 19, 26 (155 m), and 48 (201 m), and exhibited a depth range of 42 to 677 m. Most of the specimens were found at depths greater than 150 m.

Echinocythereis sp. B

Figs. 4j, 7c

This species was found at stations 14 (60 m), 15 (677 m), 31 (51 m), and 61 (484 m).

Genus *Henryhowella* Puri, 1955

Henryhowella evax (Ulrich & Bassler), 1904

Figs. 4k, 7d

Cythere evax Ulrich & Bassler, 1904, p. 119, pl. 36, figs. 6-8.

A typical deep-water species, *H. evax* was found at three stations over a depth range of 155 to 677 m. The stations were 7, 15, and 42 (155 m).

Genus *Hermanites* Puri, 1955*Hermanites reticulata* Puri, 1953

Figs. 4l, 7e

H. reticulata was found only at station 62, at a depth of 791 m.

Hermanites sp. cf. *H. wyvillethomsoni* (Brady), 1880

Fig. 7f

Cythere wyville-thomsoni Brady, 1880, p. 82, pl. 20, figs. 4a-f.

This species was found at station 7, at a depth of 549 m.

Genus *Jugosocythereis* Puri, 1957*Jugosocythereis* sp. cf. *J. vicksburgensis* (Howe & Law), 1936

Figs. 4m, 7g

Cythereis vicksburgensis Howe & Law, 1936, p. 34, pl. 4, fig. 4; pl. 5, figs. 1-2.

J. sp. cf. *J. vicksburgensis* was found at station 42, at a depth of 137 m.

Genus *Murrayina* Puri, 1953*Murrayina canadensis* (Brady), 1870

Figs. 4n, 7h

Cythere canadensis Brady, 1870, p. 452, pl. 19, figs. 4-6.

Hulings (1966) reported *M. canadensis* from the Virginia coast, at depths of 22 to 38 m. It was found living at a depth of 27 m. In the present study area, *M. canadensis* was found at only two stations (26 and 42), and in much deeper water (102 to 201 m).

Genus *Neocaudites* Puri, 1960*Neocaudites triplistriata* (Edwards), 1944

Figs. 4o, 7i

Cythereis triplistriata Edwards, 1944, p. 522, pl. 87, figs. 24-26.

N. triplistriata was found at three shallow-water stations, including 10 (31 m), 14 (60 m), and 70 (26 m).

Genus *Puriana* Coryell & Fields, 1953*Puriana rugipunctata* (Ulrich & Bassler), 1904

Fig. 7j

Cythere rugipunctata Ulrich & Bassler, 1904, p. 118, pl. 38, figs. 16-17.

This species was second in abundance and occurrence. It occurred at 28 stations, ranging from station 5 in the south to station 76 in the north. At

23 of the 28 stations, the depth was less than 60 m. The maximum depth at which *P. rugipunctata* was found was 374 m, at station 9. Hulings (1966) reported this species from the coast of Virginia.

Genus *Actinocythereis* Puri, 1953

Actinocythereis exanthemata (Ulrich & Bassler), 1904

Fig. 7k

Cythere exanthemata Ulrich & Bassler, 1904, p. 117, pl. 36, figs. 1-5.

A. exanthemata was found at four stations, including 5, 10, 20, and 69. The depth range at these stations was 18 to 49 m. This species was reported from the Virginia coast by Hulings (1966).

Suborder *PLATYCOPINA* Sars, 1866

Family Cytherellidae Sars, 1866

Genus *Cytherella* Jones, 1849

Cytherella chipolensis ? Puri, 1953

Fig. 7l

This species is considered to belong to the group of typical deep-water species. It occurred at five stations, including 9 (374 m), 15, 26 (155 and 201 m), 42 (137 m), and 48 (201 and 238 m). The depth range of these stations was 137 to 677 m.

Cytherella grossmani Benson & Coleman, 1963

Fig. 7m

C. grossmani, originally described from the Gulf of Mexico, was also found to be a deep-water species. It occurred at stations 26 (155 m), 42 (137 m), and 48 (238 m).

Genus *Cytherelloidea* Alexander, 1929

Cytherelloidea praecipua van den Bold, 1963

Figs. 4p, 7n

C. praecipua was found at only one station, 10, at a depth of 31 m.

Cytherelloidea sarsi Puri, 1960

Figs. 4q, 7o

This species was found at stations 14 (60 m), 19, and 42 (106 and 155 m). The depth range of these stations was 42 to 155 m. Kornicker (1963) collected living *C. sarsi* from three to six feet of water in the Bahamas.

SUMARIO

OSTRACODOS MARINOS DEL OCEANO ATLANTICO NOROCCIDENTAL ENTRE EL CABO HATTERAS, NORTH CAROLINA Y JUPITER INLET, FLORIDA

Un total de 72 especies de ostrácodos bénticos fueron recobrados de 54 estaciones entre Cabo Hatteras y Jupiter Inlet, Florida. Las estaciones variaron en profundidad de 9 a 795 m.

Se reconocen tres zonas de profundidades basadas en la distribución de ostrácodos. Estas zonas incluyen profundidades de menos de 50 m caracterizadas por 16 especies, una zona entre 50 y 200 m caracterizada por cuatro especies y profundidades que exceden los 200 m caracterizadas por siete especies.

La fauna reportada contiene 39 especies que parecen ser especies del Terciario, mayormente del Mioceno y post-Mioceno, 13 originalmente descritas como procedentes del Atlántico Occidental o del Golfo de México y 10 que pueden ser conespecíficas con especies originalmente descritas procedentes de aguas europeas.

Se da un recuento sistemático de las especies colectadas. Una nueva especie, *Macrocypris bathyalensis*, es descrita.

LITERATURE CITED

ANDERSON, W. A. AND J. W. GEHRINGER

- 1957a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 3. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 210, 208 pp.
 - 1957b. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 4. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 234, 192 pp.
 - 1958a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 5. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 248, 220 pp.
 - 1958b. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 6. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 265, 99 pp.
 - 1959a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 7. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 278, 277 pp.
 - 1959b. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 8. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 303, 227 pp.
 - 1960. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 9. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 313, 227 pp.
- ANDERSON, W. A., J. W. GEHRINGER, AND E. COHEN
- 1956a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V THEODORE N. GILL Cruise 1. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 178, 168 pp.
 - 1956b. Physical oceanographic, biological, and chemical data, South Atlantic

coast of the United States, M/V THEODORE N. GILL Cruise 2. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 198, 270 pp.

BAIRD, W.

1850. The natural history of the British Entomostraca. Ray Soc., London, 364 pp.

BENDA, W. K. AND H. S. PURI

1962. The distribution of Foraminifera and Ostracoda off the Gulf Coast of the Cape Romano area, Florida. Trans. Gulf Coast Assoc. Geol. Soc., 12: 303-341.

BENSON, R. H. AND G. L. COLEMAN

1963. Recent marine ostracodes from the eastern Gulf of Mexico. Univ. Kansas Paleontol. Contrib., Art. 2: 1-52.

BRADY, G. S.

1866. On new or imperfectly known species of marine Ostracoda. Trans. Zool. Soc. London, 5: 359-393.

1869. Descriptions of Ostracoda. *In*: Les fonds de la mer, 1: 1-316.

1870. Contributions to the study of the Entomostraca. V. Recent Ostracoda from the Gulf of St. Lawrence. Ann. Mag. Nat. Hist., 6: 450-454.

1880. Report on the Ostracoda dredged by H.M.S. CHALLENGER during the years 1873-76. Report on the scientific results of the voyage of H.M.S. CHALLENGER, Zool., 1 (3): 1-184.

BRADY, G. S. AND D. ROBERTSON

1874. Contributions to the study of the Entomostraca. IX. On Ostracoda taken amongst the Scilly Islands, and on the anatomy of *Darwinella stevensoni*. Ann. Mag. Nat. Hist., 13: 114-119.

DARBY, D. G.

1965. Ecology and taxonomy of Ostracoda in the vicinity of Sapelo Island, Georgia. *In*: Kesling, R. V., D. G. Darby, R. N. Smith, and D. D. Hall, Four reports of ostracod investigations conducted under National Science Foundation Project GB-26. Univ. Michigan Museum Paleontol.

EDWARDS, R. A.

1944. Ostracoda from the Duplin marl (upper Miocene) of North Carolina. J. Paleontol., 18: 505-528.

HILL, B. L.

1954. Reclassification of winged *Cythereis* and winged *Brachycythere*. J. Paleontol., 28 (6): 804-826.

HOWE, H. V. AND GRADUATE STUDENTS

1935. Ostracoda of the *Arca* zone of the Choctawhatchee Miocene of Florida. Florida Geol. Surv., Bull. No. 13, 47 pp.

HOWE, H. V. AND J. LAW

1936. Louisiana Vicksburg Oligocene Ostracoda. Louisiana Dept. Cons. Geol. Bull., 7: 1-96.

HULINGS, N. C.

1958. An ecological study of Recent ostracods of the west coast of Florida. Trans. Gulf Coast Assoc. Geol. Soc., 8: 166 (Abstr.).

1959. A comparison of Recent ostracod faunas of the Gulf of Mexico and the South Atlantic coast of the United States. Preprints Internat. Oceanogr. Cong.: 158-160.

1966. Marine Ostracoda from the western North Atlantic Ocean off the Virginia Coast. Chesapeake Sci., 7 (1): 40-56.

- HULINGS, N. C. AND H. S. PURI
1964. The ecology of shallow water ostracods of the West Coast of Florida. Publ. Staz. Zool. Napoli, 33 (Suppl.): 308-344.
- JONES, T. R.
1857. A monograph of the Tertiary Entomostraca of England. Paleontol. Soc. London, 68 pp.
- KORNICKER, L. S.
1958. Ecology and taxonomy of Recent marine ostracodes in the Bimini area, Great Bahama Bank. Publ. Inst. Mar. Sci., 5: 194-300.
1961. Ecology and taxonomy of Recent Bairdiinae (Ostracoda). Micropaleontology, 7 (1): 55-70.
1963. Ecology and classification of Bahamian Cytherellidae (Ostracoda). Micropaleontology, 9 (1): 61-70.
- MARTIN, J. L.
1939. Claiborne Eocene species of the ostracod genus *Cytheropteron*. J. Paleontol., 13: 177.
- MOORE, J. E. AND D. S. GORSLINE
1960. Physical and chemical data for bottom sediments, south Atlantic coast of the United States, M/V THEODORE N. GILL Cruises 1-9. U. S. Fish Wildl. Ser., Spec. Sci. Rept.: Fisheries, No. 366, 84 pp.
- MÜLLER, G. W.
1894. Die Ostracoden des Golfes von Neapel und der angrenzenden Meeresabschnitte. Fauna und Flora des Golfes von Neapel, Zoologisch. Stat. Neapel, Monogr. No. 31, 404 pp.
- MÜLLER, O. F.
1785. Entomostraca sev insecta testacea, quae in aquis daniae et norvegiae reperit, descripsit et inconubus illustravit. Lipsiae et Havniae, 135 pp.
- NEALE, J.
1964. Some factors influencing the distribution of Recent British Ostracoda. Publ. Zool. Staz. Napoli, 33 (Suppl.): 247-296.
- NORMAN, A. M.
1865. Report on the Crustacea dredged off the coasts of Northumberland and Durham, 1862-1864. Nat. Hist. Trans. Northumberland and Durham, 1: 12-29.
- PURI, H. S.
1952. Ostracode genus *Cytheridea* and its allies. J. Paleontol., 26: 902-914.
1953. Contribution to the study of the Miocene of the Florida Panhandle. Florida Geol. Surv., Bull. No. 36, 309 pp.
1960. Recent Ostracoda from the west coast of Florida. Trans. Gulf Coast Assoc. Geol. Soc., 10: 107-149.
- PURI, H. S. AND N. C. HULINGS
1957. Recent ostracod facies from Panama City to Florida Bay. Trans. Gulf Coast Assoc. Geol. Soc., 7: 167-190.
- ROTHWELL, W. T.
1949. Preliminary report on Ostracoda in bottom samples and cores of northwestern Gulf of Mexico. Bull. Geol. Soc. Am., 60: 1918.
- SARS, G. O.
1866. Oversigt af Norges marine ostracoder. Fördhandl. Vidensk. Selskab Christiania, 7: 1-130.
- STEPHENSON, M. B.
1938. Miocene and Pliocene Ostracoda of the genus *Cytheridia* from Florida. J. Paleontol., 12: 127-148.

1944. New Ostracoda from subsurface middle Tertiary strata of Texas. *J. Paleontol.*, 18: 156-161.
- TRESSLER, W. L.
1940. Ostracoda from Beaufort, No. Carolina, sand beaches. *Am. Midland Naturalist*, 24 (2): 365-368.
1942. Geology and biology of North Atlantic deep-sea cores between Newfoundland and Ireland, Pt. 4. Ostracoda. *U. S. Geol. Surv. Prof. Pap.*, No. 196.
1949. Marine Ostracoda from Tortugas, Florida. *J. Washington Acad. Sci.*, 39: 335-343.
1954. Marine Ostracoda. *Fish. Bull.*, 89: 429-437.
- TRESSLER, W. L. AND E. M. SMITH
1948. An ecological study of seasonal distribution of Ostracoda, Solomons Island, Maryland, region. *Chesapeake Biol. Lab.*, Publ. No. 71, 61 pp.
- ULRICH, E. O. AND R. S. BASSLER
1904. Systematic paleontology of the Miocene deposits of Maryland. *Maryland Geol. Surv.*, Miocene Rept.: 98-130.
- VAN DEN BOLD, W. A.
1946. Contribution to the study of Ostracoda with special reference to the Tertiary and Cretaceous microfauna of the Caribbean region. *Dissertation, Univ. Utrecht*, 167 pp.
1950. Miocene Ostracoda from Venezuela. *J. Paleontol.*, 24: 76-88.
1963. Anomalous hinge structure in a new species of *Cytherelloidea*. *Micro-paleontology*, 9: 75-78.